

SECTION 4

QUESTION 3: Again, based upon the technical judgment of the panel, are the spatial and temporal scales of the modeling approaches adequate to address the principal need for the model-producing sufficiently accurate predictions of the time to attain particular PCB concentrations in environmental media under various scenarios (including natural recovery and different potential active remedial options) to support remedial decision-making in the context described in the background section of the charge? If not, what levels of spatial and temporal resolutions are required to meet this need?

4.1 SPATIAL DOMAIN OF THE MODELS

The MFD describes the model domain (for EFDC and AQUATOX) as the reach of the Housatonic River between the East/West Branch confluence and Woods Pond Dam (MFD page 4-3). Models describing PCB fate, transport, and bioaccumulation will be developed and calibrated for this reach of the River. This domain is too limited for the intended application of these models. It does not include the reach of the River adjacent to the GE plant site (located upstream of the confluence), which is currently undergoing remediation. Additionally, the model domain excludes reaches of the River downstream of Woods Pond Dam.

By not including the River reach adjacent to the plant site within the model domain, the USEPA will miss an important model calibration opportunity. This reach, referred to in the Consent Decree as the Upper ½ Mile Reach, will be remediated before completion of the PCB fate models. Specifically, under the Consent Decree, GE is conducting extensive remediation of the Upper ½ Mile Reach through a combination of removal/replacement of the upper layers of sediments (to depths of up to 2 feet or more) and isolation/containment of the underlying contaminated sediments, along with removal and replacement of certain affected riverbank soils. This remediation is approximately half completed and will continue in 2001. Moreover, following completion of the remediation of this reach, USEPA will begin remediation of the next 1½ Mile Reach (between the Upper ½ Mile Reach and the East/West Branch confluence) pursuant to the Consent Decree. Extension of the model to include the River adjacent to and

immediately downstream of the GE plant site will thus allow for model predictions of the effect of the remediation on PCB levels at downstream locations. Monitoring data collected after the Upper ½ Mile Reach remediation is complete could then be used to evaluate model predictions and refine model calibrations. This may be of particular importance for the bed load component of the PCB fate model calibration. The model domain should be extended to include the reach adjacent to and immediately downstream of the plant site to take advantage of this unique calibration opportunity.

The model domain presented in the MFD only extends to Woods Pond Dam. Therefore, the model will be unable to predict the impact of sediment remediation activities on PCB levels downstream of the Dam. One of the objectives of the modeling effort is to evaluate future spatial distribution of PCBs including the impacts of a rare flood event (MFD page 1-2 and 1-5). Such impacts would likely extend downstream of Woods Pond Dam. Moreover, fish consumption advisories are in place extending downstream in Massachusetts to the MA/CT border (and in the Connecticut portion of the Housatonic River as well), and a duck consumption advisory has been issued for the portion of the River from Pittsfield to Rising Pond Dam (see MFD page 2-2). In these circumstances, it is important for the model to include at least a portion of the River between Woods Pond Dam and the Massachusetts/Connecticut border. By extending the model domain further downstream, the impact of sediment remediation in the reach between the confluence and Woods Pond Dam on downstream sediment, water column, and biota PCB levels can be directly and objectively assessed. Without such an extension, extrapolation of downstream impacts of remedial action scenarios will be unconstrained and subject to considerable uncertainty.

The benefits of extending the model domain to include the reach of the River adjacent to and immediately downstream of the plant site as well as reaches downstream of Woods Pond Dam would be well worth the incremental model development effort. Extension of the domain would allow verification of key model processes and provide an engineering tool for directly quantifying the impact of potential remediation scenarios on PCB levels downstream of Woods Pond Dam.

4.2 MISMATCH IN THE LEVEL OF DETAIL BETWEEN EFDC AND AQUATOX

The MFD describes, in detail, the procedures for evaluating the various model grid schemes for the EFDC model of hydrodynamics and sediment transport (MFD pages 441 to 447). However, it does not appear to have considered the extent to which fine-scale hydrodynamic features, such as lateral gradients in river velocity and the existence of turbulent eddies, are important for the ultimate uses of the model. While these features exist and can be pronounced within the meandering portions of the River, their significance to the stated objectives of the modeling study is less clear.

There are little data at the spatial resolution under consideration. For example, while lateral velocity measurements are being collected from the test reach, no plans have been presented for collection of suspended solids and PCB data at a similar scale. Hence, the calibration of the sediment transport model will have to be made with data at a coarser scale than that calculated by a fine-grid model. Any fine-scale calculations developed using EFDC (e.g. lateral variations in sediment resuspension and deposition) will be aggregated into the coarser-scale grid employed by AQUATOX to calculate PCB fate. The information gained by simulating these finer-scale processes will be lost in the collapse into the AQUATOX grid, unless these fine-scale processes dominate sediment transport at the coarse scale of AQUATOX. The MFD presents no data indicating that such dominance is likely, nor a plan to evaluate the importance of the fine-scale processes to PCB fate. Such a plan is needed to provide a basis for determining the needed resolution of EFDC.

4.3 CHOICE OF GRID SCHEME

As discussed earlier, the procedure described in the MFD for designing an “optimal” numerical grid for the R/FP model appears rational and logical. The type of numerical grid, and its spatial resolution, will be determined based on the ability of the model to replicate site-specific measurements of current velocity, stage height and TSS concentration in the test reach.

While this approach seems reasonable, it does not appear to have been based on consideration of the primary goal of the modeling, which is to describe PCB fate and transport in the River on a scale that is relevant to questions of natural recovery and the efficacy of various remedial alternatives. This goal should be the primary criterion guiding grid design. For example, if natural recovery and remedial actions will be evaluated on the scale of individual aggrading bars and terraces, then resolution of the model at a scale that resolves these features of the River is warranted. However, if the focus will be on a broader scale (e.g. whole segments of the River), then the finer resolution is not necessary. This issue of the spatial scale of the modeling effort is relevant because of the computational burden inherent to fine-grid representations of the system.

This approach to grid design focuses on relatively fine-scale hydrodynamic and sediment transport processes, which may be quite interesting from a scientific perspective, but may not be significant at the remedial scale under consideration. For example, the ability of the model to reproduce lateral gradients in current velocity, based on site-specific data, will be used to investigate lateral grid resolution. Clearly, lateral velocity gradients exist in the main channel of the Housatonic River and a minimum of three lateral grid cells would be needed to resolve those gradients. However, the important question is whether lateral gradients impact the model's ability to adequately simulate PCB fate and transport in the River. The Agency should consider the relevant spatial scales for the remedial actions under consideration for the system prior to establishing the spatial grids for the models.

Another consideration for grid design is the spatial and temporal resolution of data used to develop and calibrate the model. While most models tend to have higher resolution than the available data, the numerical grid should be approximately commensurate with the spatial resolution of the data.